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## PILE WEATHERSTRIPPING DUST PLUGS

### Description

This application claims the benefit of priority to U.S. Patent Application No. 60/465,079, filed April 24, 2003, which is herein incorporated by reference.

### Field of the Invention

The present invention relates to pile weatherstripping dust plugs, and particularly, to lengths of which are disposed adjacent to each other to provide a block seal to provide a dust plug, and to a method for making such dust plugs, efficiently, rapidly, and at low cost. A dust plug is located along the bottom of a doorjamb or on the side of a window sash in the frame of the window and seals against air or water infiltration in areas where gaps may be left by other weatherstripping.

### Background of the Invention

Heretofore, pile weatherstripping plugs have been made from separate segments assembled to a base which adheres to the back sides of the backing strips of the segments. The structural integrity of such pile weatherstrip dust plugs is dependent entirely on the adhesive connection to the base, which is not as reliable and long lasting as desired. Thus, pile weatherstrip dust plugs would be desirable having structural integrity which affords enhanced reliability, as well as facilitates the automated manufacture of the dust plugs from continuous lengths of pile weatherstripping.

### Summary of the Invention

Briefly described, the present invention provides a dust plug made from pile weatherstripping having a backing strip from which the pile extends; the backing strips being partially severed, leaving portions forming hinges in staggered relationship along opposite edges of the backing strip to provide hinged segments. The segments are folded like an accordion against each other and assembled with a backing sheet, which may be adhesively connected to the side of the segments opposite to the side from which the pile thereon extends.

The pile weatherstripping, which is converted into segments which are hinged in staggered relationship, several of which may be accordion folded and disposed in edge to edge relationship so as to provide dust plugs, may be of the type described in U.S. Patent Nos. 4,148,953, issued April 10, 1979 to Robert C. Horton and 4,302,495, issued November 24,

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1981, also to Robert C. Horton, and U.S. Patent No. 5,338,382, issued August 16, 1994 to Larry E. Johnson et al.

One feature is that by virtue of the zigzag interconnected structure of integral, hinged segments, the dust plug has high structural integrity and may readily be manufactured at low cost.

Another feature of this invention to use pile weatherstripping having an air and water infiltration barrier, sometimes called a fin, inside the pile. The fin bridges the hinges when the segments are folded and disposed in edge-to-edge relationship. The fin weaves along a serpentine path through the plug and provides a barrier to air and water infiltration from any side edge of the plug. Accordingly, installation of the dust plug is not orientation sensitive and the barrier provided by the fin is maintained regardless of the orientation of the plug upon installation, as in doorjamb or window sashes or elsewhere.

#### Brief Description of the Drawings

The foregoing and other objects, features and advantages of the invention will become more apparent from the reading of the following description in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a pile weatherstrip dust plug in accordance with the invention;

FIG. 2 is a top view of the dust plug shown in FIG. 1;

FIG. 3 is an end view of the dust plug shown in FIG. 1;

FIG. 4 is a front view of the dust plug shown in FIG. 1;

FIG. 5 is a perspective view, diagrammatically showing the manufacture of a pile weatherstrip dust plug shown in FIG. 1;

FIG. 6 is a fragmentary enlarged perspective view of the right hand end of FIG. 5;

FIG. 7 is a front view showing the folding and assembly in edge-to-edge relationship of hinged segments of weatherstripping as shown in FIG. 6;

FIG. 8 is a perspective view schematically illustrating the severing of a continuous length of pile weatherstripping into hinged segments;

FIG. 8A is a sectional view along a plane parallel to one of the blades used to sever the pile weatherstripping into hinged segments, the view being taken generally along line 8A-8A in FIG. 8 and in the direction of the arrows;

FIG. 8B is an enlarged sectional view showing a severed end of a hinged segment of the pile weatherstripping;

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FIG. 9 is a view from the bottom in FIG. 8 of one of the blades in the course of severing the pile weatherstripping into hinged segments;

FIGS. 10, 11 and 12 are perspective views showing a door in a door jamb in different positions during closing of the door away from the dust plug, engaging the dust plug, and closing against the jamb with a gap at the base of the door being closed by the dust plug, respectively;

FIGS. 13, 14 and 15 are perspective views of the areas A, B and C shown in FIGS. 10, 11 and 12, as the door closes against the door jamb and is sealed at the lower edge of the door jamb by the dust plug;

FIGS. 16, 17 and 18 are perspective views of the areas A, B and C shown in FIGS. 16A, 17A and 18A, and are views similar to FIGS. 13, 14 and 15, respectively, but with the dust plug oriented so that the door engages the ends of the hinged segments, rather than a side edge of an outside hinged segment; the later being the case shown in FIGS. 13, 14 and 15;

FIG. 19 is a view similar to FIG. 5, but showing the pile weatherstripping without an interior fin;

FIG. 20 is a perspective view illustrating a jig which may be used to facilitate the folding of the hinged segments of weatherstripping as shown in FIG. 19;

FIG. 21 is a perspective view illustrating the manufacture of a dust plug according to another embodiment of the invention, having lengths of pile weatherstripping along the ends of the hinged segments; and

FIG. 22 is a perspective view illustrating a pile weatherstripping dust plug according to still another embodiment of the invention which has a pair of folded hinged segments with lengths of pile weatherstripping assembled with the folded pair of segments along the outside ends and between the inside ends thereof; the embodiments shown in FIGS. 21 and 22 are especially adapted to provide dust plug seals which are longer and which may be wide than the seals shown in FIGS. 1-20.

#### Detailed Description of the Invention

Referring now more particularly to FIGS. 1-4, there is shown a pile weatherstripping dust plug 15 using six segments 16, 17, 18, 19, 20 and 21 of pile weatherstripping 6 having a barrier fin 4. The fin 4 weaves through and around the ends of the segments 16-21 in a serpentine path. Fin 4 has five loops at turns 8 at opposite ends 22 and 23 of the plug 15. The pile 6 may represent a brush of yarn of suitable polypropylene material, or other material may provide such brush. The pile 6 extends from one side of a base or backing strip 7. The backing strip 7 and fin 4 may also be of polypropylene material. The pile 6 may be

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ultrasonically welded to the backing strip 7 between pile directors or flanges 24 on the sides of each of segments 16-21 of the backing strip 7 from which the pile 6 extends.

The width of the backing strips 7 is preferably narrow and generally square as viewed from the ends 22 and 23 of the plug 15. The height of the backing strips 7 in the vertical direction is preferably sufficient to provide wide surfaces against which the edges of the strips in adjacent segments bear against each other.

The lineal pile weatherstripping 1 used to provide segments of pile 6 is of the type commercially available from Ultrafab, Inc. of Farmington, New York, USA, and is similar to the pile weatherstripping described in the above-referenced Horton and Johnson et al. patents. While the use of pile weatherstripping having a central barrier fin may be preferable in most applications, dust plugs in accordance with the invention may be made from pile weatherstripping without such fins. FIGS. 19-22 show dust plugs embodying the invention having hinged segments of pile weatherstripping, without barrier fins. If additional air infiltration control is desirable, dust plugs in accordance with the invention may be made from thin sections of lineal pile having fins on the outside of the pile as well as on the inside thereof. Such pile weatherstripping is, for example, described in the above-referenced Johnson et al. patent.

The segments 16-21 of pile 6 are integral with each other, being interconnected at hinges 3 adjoining adjacent pairs of segments have these hinges at opposite ends of alternate segments. The segments 16-21 may be of equal length and the hinges 3 are spaced from each other along the opposite edges of the plug 15. The loops 8 of fin 4 material bridge the hinges 3 and also enhance the integral structure of the dust plug 15. The fin 4 material may be co-terminus with the top of the pile 6 or may extend above the top of the pile, as shown in FIG. 4.

The backing strip 7 has slits or notches which are in staggered relationship by virtue of the slots which are adjacent to each other along the longitudinal or lineal length of the weatherstripping 1 extending into the backing strip 7 from opposite edges thereof, leaving sufficient material between alternate pairs of segments to define the hinges 3. The depth of material at the hinges 3 may suitably be .030 inches (30 mils) in polypropylene. These hinges may be thought of as creases in staggered relationship along the opposite edges of the lineal weatherstripping 1. This facilitates the bending or folding of the segments in an accordion or zigzag like manner into the block shape. The block shape is shown as being rectangular but may be square, depending upon the intended application, that is the configuration of the air gap between a door jamb and door or sliding sash members of a window in which the dust plug 15 is to be installed.

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By virtue of the narrow width of the backing strip 7, the pile 6 in adjacent segments may be compressed as shown in FIGS. 1-4. If less air infiltration control is desired, the backing strips may be wider so that the pile is less compressed and allows greater air infiltration through the dust plug 15.

Due to the serpentine path of the fin 4, the fin 4 presents an air infiltration barrier regardless of the orientation of the dust plug 15. In some applications, the plug 15 will be installed so that the front or back side surface where the length of the pile is presented to the surface to be sealed (the surface shown in FIG. 4) is presented to the closing member (e.g., door or window). In other applications, especially where greater resistance to closing is desired from the plug 15, the end surface where the loops 8 appear may be presented to the closing member. Then, the plug may present a greater resistance to closing by the closing member than in the case where the side surface of the plug is presented to the closing member. Such installations where the dust plug 15 is installed as a dust stop block seal 12 in a gap between a doorjamb, and a door, are shown in FIGS. 10-18.

A sheet 5 which is coated with adhesive on at least one side is applied to the back side of the compressed, folded hinged segments 16-21 to assemble the segments permanently connected to each other in edge to edge relationship as shown in FIG. 1. The outside of the sheet 5 may have a layer of adhesive material which is covered by a release sheet. The release sheet is not shown and may be removed to secure the dust plug 15 in a doorjamb or window sash.

Adjacent segments may be assembled into a plug 15 by welding, such as ultrasonic welding at seams along the adjoining edges of the adjacent segments. The ultrasonic weld may be a butt-weld between the adjacent edges of backing strip 7 of adjacent pile segments, or a bridging strip may be welded at or over these edges. The use of an adhesive sheet 5, which may be continuously applied to the folded segments, as shown in FIG. 5, 6 and 7, is preferred. Then, a continuous array of folded segments, attached to the sheet 5 may be produced. Dust plugs of desired length may be obtained by severing the backing sheet 5 at certain seams between adjacent edges of the segments. For purposes of illustration, the plug 15 shown in FIGS. 1-4 has six segments 16-21, any number of two or more segments may be used to provide the plug.

The process by which the plugs 15 may be manufactured from continuous lengths of lineal pile weatherstripping 1 and sheets 5 of adhesive material of width equal to the length of the hinged segments will be more apparent from FIGS. 5-9. As the weatherstripping 1 is advanced in the direction shown by the arrows 14, staggered blades 2 with razor edges are

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rotated along about the center of a shaft and provides a circularly arcuate cut 27 through the backing strip 7. The center hole 26 of each blade 2 for its respective rotatable shaft, and the cut 27 made by each blade 2 is best shown in FIGS. 8A and 8B. The cut makes a slit or notch, arcuate at its inside end, leaving material which becomes the hinge 3. The cut may extend partially through the bottom of the fin 4 at the ends of the segments. The area of the opening in the fin 4 is minor and does not affect the integrity of the plug or the performance of the plug so far as air infiltration is concerned. The blades 2 are offset along opposite edges of the pile weatherstripping 1, and the blades are separated so as to define the segments of desired length. The segments are then folded so that they adjoin each other and abut when the adhesive sheet 5 is applied. A suitable jig or tool, for example, such as shown in FIG. 20, may be used to constrain the segments as they are advanced and folded in an accordion-like manner. It will be noted that the loops 8 are formed as the segments are folded against each other.

Referring to FIGS. 10-18, there is shown a doorjamb 9 having a jamb surface against which a door 10 closes. The door 10 may have a doorsill seal 11. A gap is left between the outer edge of the seal 11 and the doorjamb 9. This gap is filled by the dust plug 15 which is attached at the back side thereof to the jamb 9. When installed as shown in FIGS. 13, 14 and 15, with the longitudinal side 15a presenting the edge of the brush of pile 6 to the door 10, less resistance to closing is presented than is the case shown in FIGS. 16, 17 and 18 where the end 15b (representing ends 22 or 23 of FIG. 1) of plug 15 is presented to the closing door 10. In the orientation of the dust plug 15 shown in FIGS. 13-15 as well as in the orientation shown in FIGS. 16-18, the dust plug 15 provides seal 12 when the door 10 is in a closed position (door is illustrated closed in FIG. 14 or FIG 18). The fin as well as the pile presents a barrier to air and water infiltration through the gap between the sill 11 and the doorjamb 9. Accordingly, the dust plug provided by the invention is flexible in affording different, selectable orientations upon installation to meet different application conditions.

Referring to FIGS. 19 and 20, there is shown lineal weatherstripping 30 without a central fin which is severed into hinged segments 32 and folded like an accordion so that the segments lie adjacent to each other. A tool having side members 34 and 36 on a base 42 aligns the segments into side-by-side relationship. As in FIG. 5, the lineal weatherstripping 30 is advanced in the direction shown by the arrow 14, as by a driving wheel which engages the weatherstripping into the tool and causes the segments 32 to be disposed adjacent to each other. The adhesive sheet 5 may be applied to the adjoining segments as they leave the tool between the side members 34 and 36.

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As shown in FIG. 21, lineal pile weatherstripping 50 is cut into hinged segments 58 which are folded into adjoining relationship between exterior lengths 60 and 62 of uncut (i.e., unsegmented) pile weatherstripping. The adhesive sheet 5 assembles the side lengths of pile weatherstripping and the adjoining segments 58 into an integral structure. The assembled structure may be cut into lengths including different numbers of segments 58 and different lengths of the linear side pile weatherstrips 60 and 62.

As shown in FIG. 22, two lineal lengths of pile weatherstripping 52 and 54 may be severed to form hinged segments 61 and 63, respectively, and then folded so that they adjoin each other. The ends of the segments are disposed against an inside length 53 of pile weatherstripping and two outside lengths 57 and 59 of pile weatherstripping. An adhesive sheet 5, which bridges the assembly of lineal lengths 53, 57 and 59 and folded adjoining segments 61 and 63, may be used to assemble the structure. The assembled structure may be cut into lengths including different numbers of segments 61 and 63 and different lengths of the side pile weatherstrips 53, 57 and 59. When side weatherstrips 60 and 62 as shown in FIG. 21 or 53, 57 and 59 as shown in FIG. 22, the hinged segments are fully supported along their ends so that the dust plug seals may be of lengths longer than the case where the ends are unsupported. Such dust plug seals may, for example, be flexible members as much as several meters in length.

From the foregoing description, it will be apparent that there has been provided, improved pile weatherstripping devices, especially suitable for use as block seals or dust plugs. Variations and modifications in the herein described devices and their methods of manufacture will undoubtedly suggest themselves to those skilled in the art. Accordingly, the foregoing description should be taken as illustrative and not in a limiting sense.